Fermilab

Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

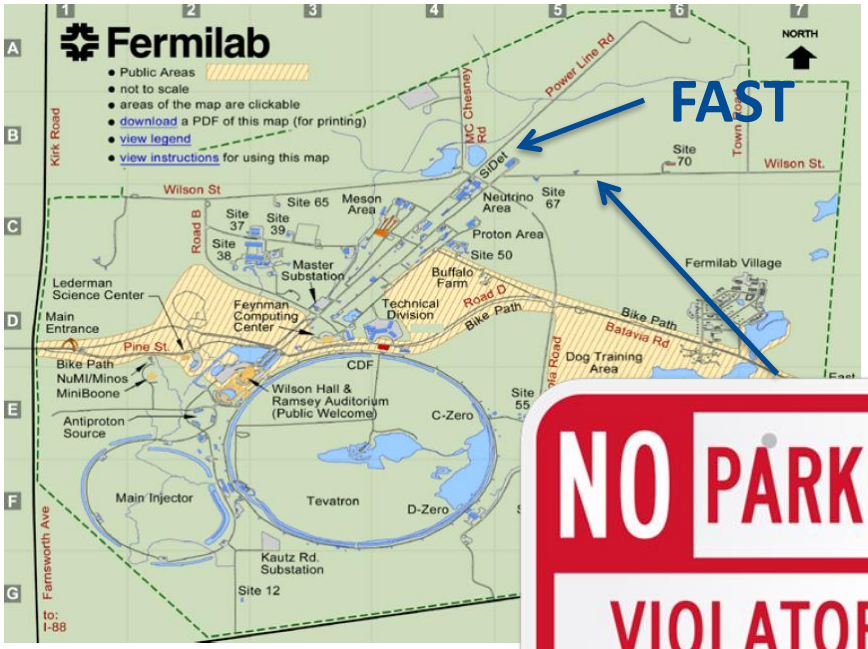
Commissioning and Plans of the IOTA Electron Injector

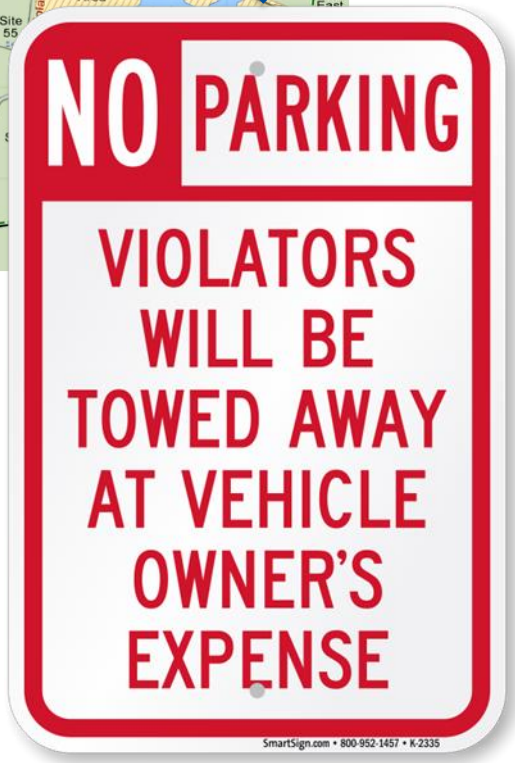
Dan Broemmelsiek

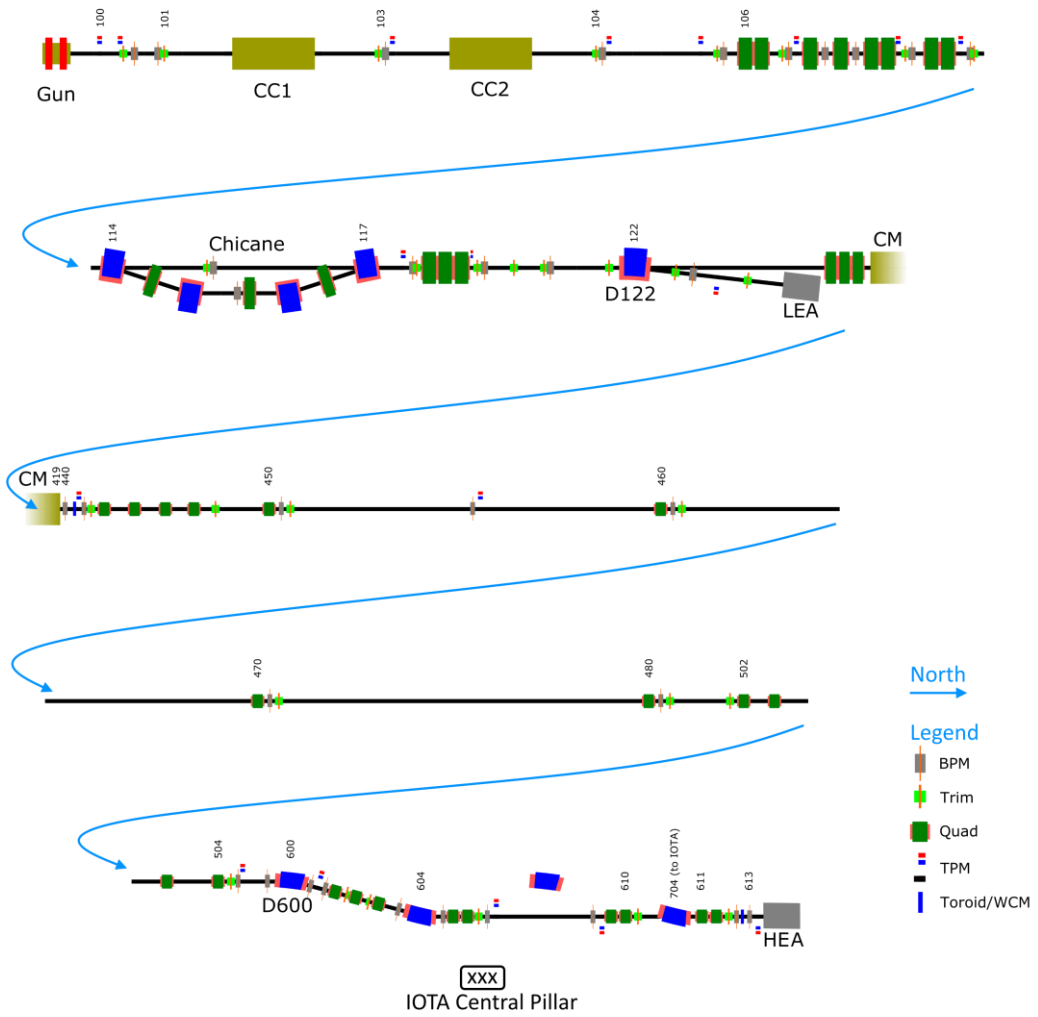
FAST/IOTA Scientific Program Meeting

5 June 2017

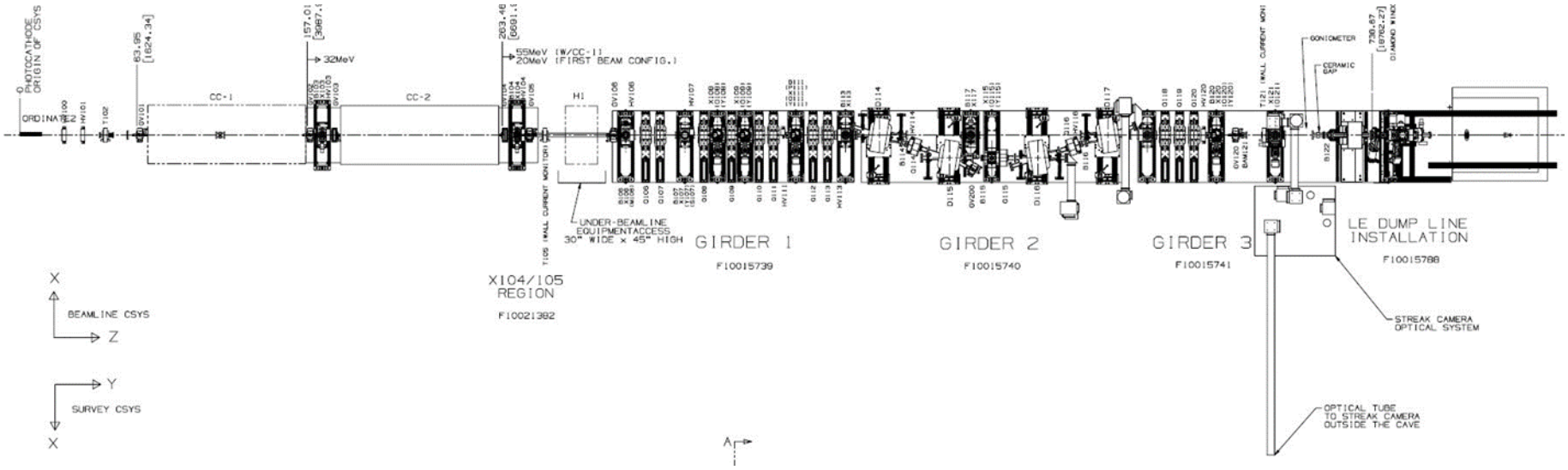
Location


Fermilab
Public Areas
not to scale
areas of the map are clickable
download a PDF of this map (for printing)
view legend
view instructions for using this map
NORTH
FAST
Power Line Rd
MC Cheseney Rd
SiDet
Site 70
Wilson St.
Wilson St
Site 65
Meson Area
Neutrino Area
Site 67
Site 37
Site 39
Site 38
Proton Area
Site 50
Master Substation
Buffalo Farm
Fermilab Village
Lederman Science Center
Feynman Computing Center
Technical Division
Road D
Bike Path
Batavia Rd
Main Entrance
Pine St
Dog Training Area
CDF
Bike Path
NuMI/Minos
MiniBoone
Wilson Hall & Ramsey Auditorium (Public Welcome)
C-Zero
Antiproton Source
Main Injector
Tevatron
D-Zero
Kautz Rd. Substation
Site 12
Kirk Road
Road B
Farnsworth Ave
to: I-88


NO PARKING
VIOLATORS WILL BE TOWED AWAY AT VEHICLE OWNER'S EXPENSE
SmartSign.com • 800-952-1457 • K-2335


100
101
103
104
106
Gun
CC1
CC2
114
Chicane
117
122
D122
CM
LEA
CM
449
450
460
470
480
502
504
600
D600
604
610
704 (to IOTA)
611
613
HEA
XXX
IOTA Central Pillar
North
Legend
BPM
Trim
Quad
TPM
Toroid/WCM

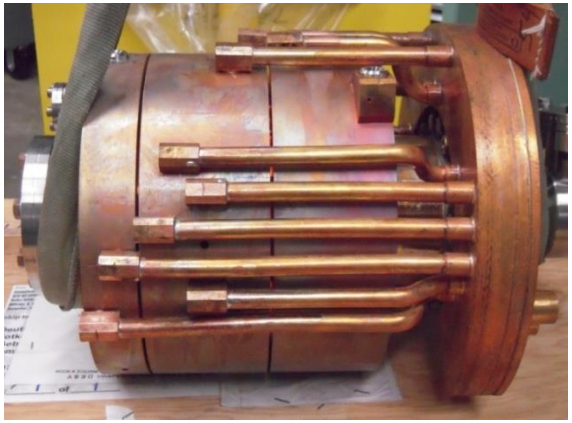
Electron Injector



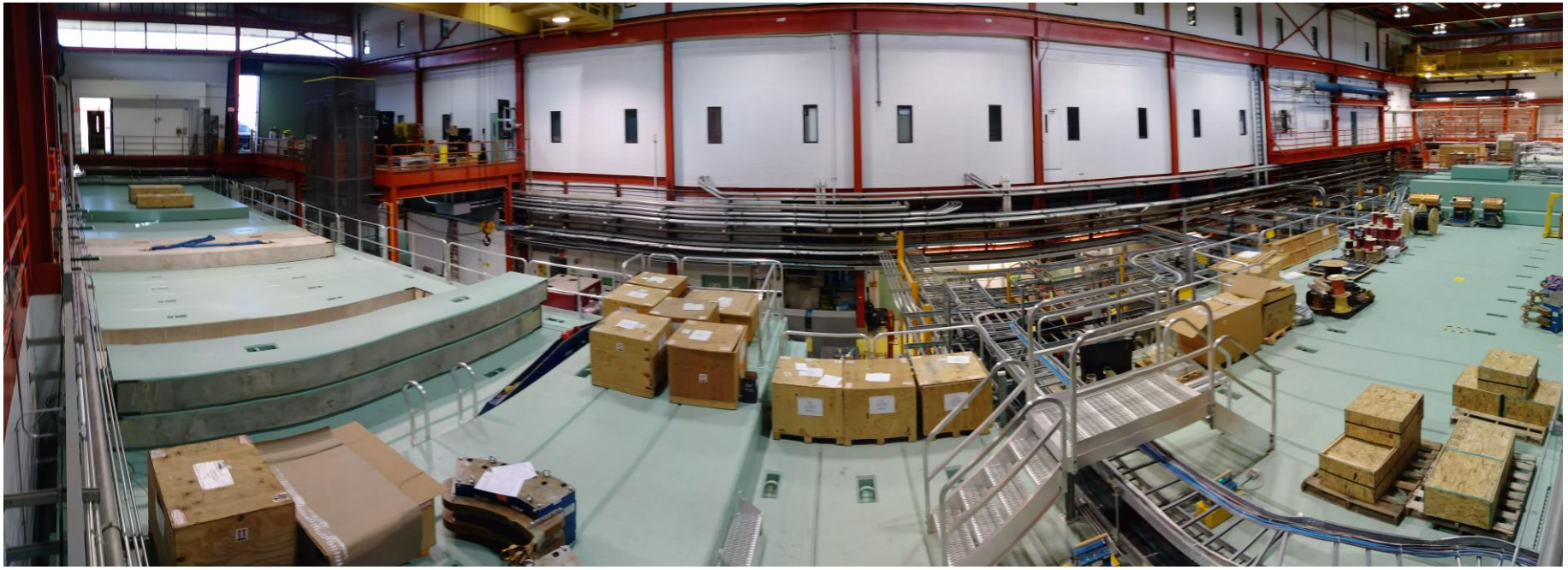
Parameter	Value	Unit
Bunch charge	0.02 – 3.2	nC
Bunch train duration	1	ms
Bunch frequency within train	3	MHz
Number of bunches/train	1 – 3000	
Bunch train frequency	1 – 5	Hz

Gun and Capture Cavities

- 1.3 GHz, normal conducting, 1.5 cell RF electron gun
  - Cs_2Te photocathode excited by 254 nm uv laser
  - Gun 42 MV/m, ~4.5 MeV electrons
- Two 1.3 GHz 9-cell SRF cavities
  - CC1 at 27.5 MV/m
  - CC2 at 17 MV/m
  - Parameter scaling, spectrometer based beam energy > 50 MeV



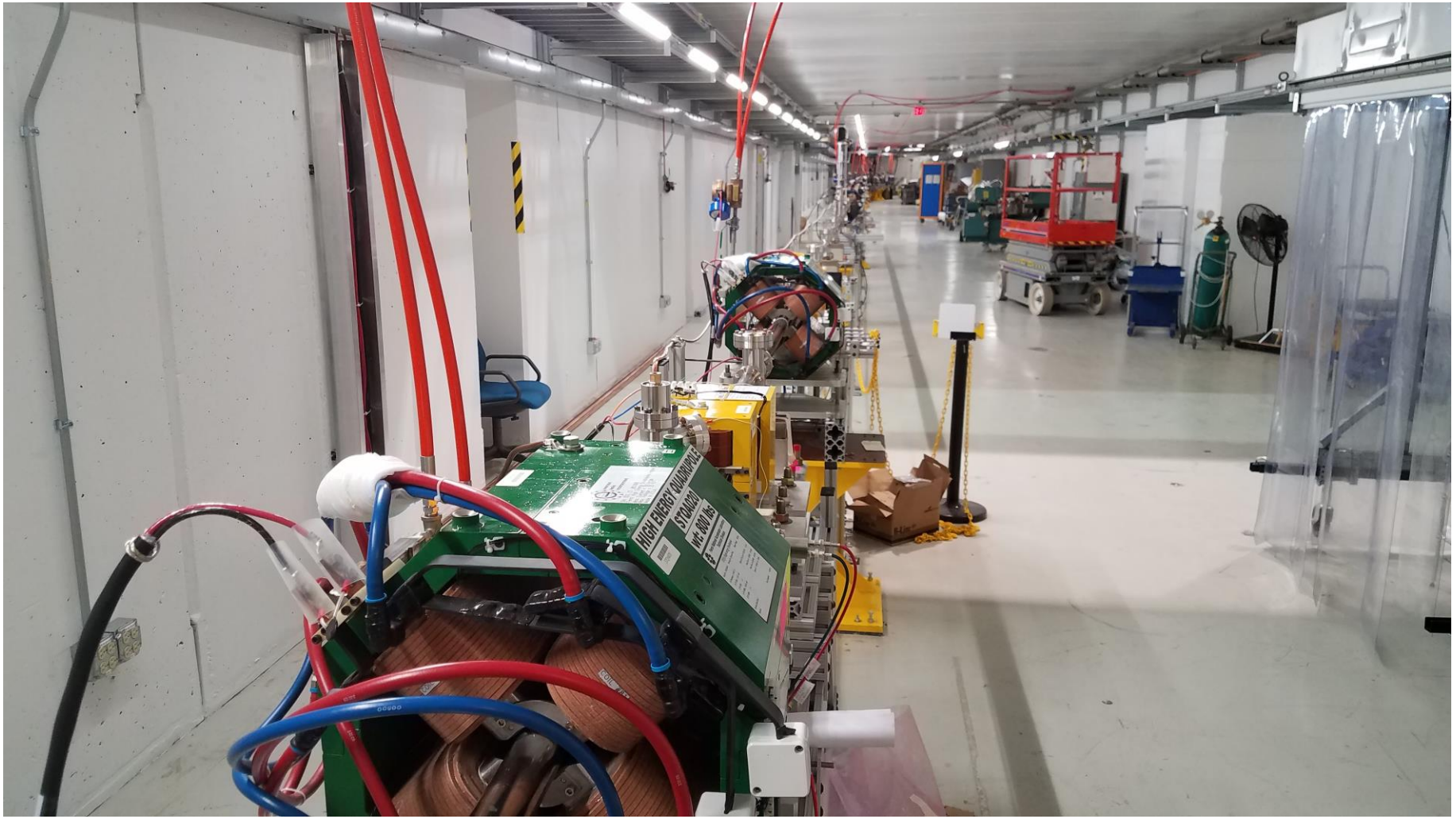
Construction



Construction

Installation

Installation



Fermilab

Schedule/Planning

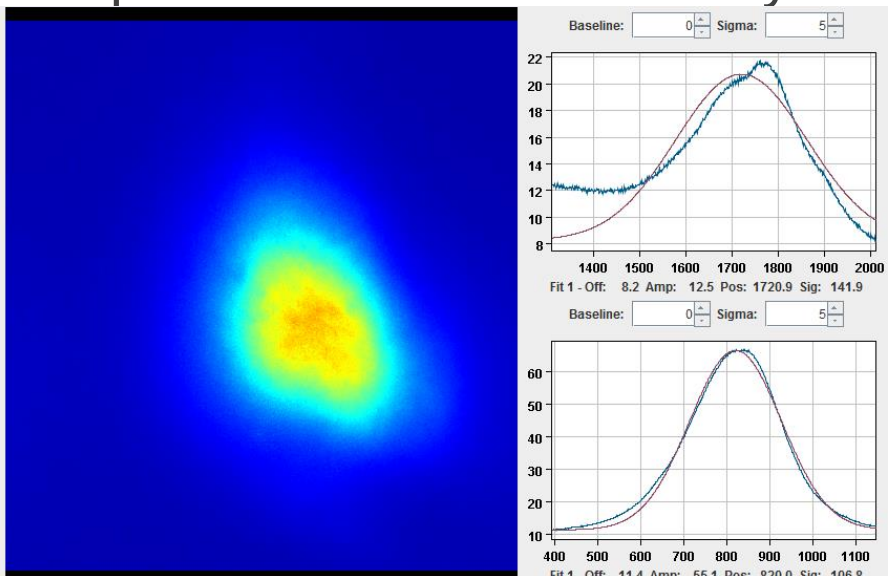
- Installation/Assembly/Fabrication
- Commissioning/Testing/Documentation
- Review/Approval/ORC
- Critical Path items/Issues
- Complete

Task Description	10-Mar	17-Mar	24-Mar	31-Mar	7-Apr	14-Apr	21-Apr	28-Apr	5-May	12-May	19-May	26-May	2-Jun	9-Jun	16-Jun	23-Jun	30-Jun	7-Jul
	March				April				May						June			
Utilities																		
Water, Air, Nitrogen														air to valves				
HE Dump & helium system														helium sys.				
Water hoses to magnets as they are ready														Tuesday				
Electrical																		
Cable Pulls																		
Cable Termination/connection																		
Interlocks/key tree/rad. detectors																		
Power Supplies														Test P.S.				
Install Ground Cable																		
Mechanical																		
Stands (vac. cross, radiabeam, etc.)																		
Magnets																		
Vacuum																		
Atlas Chamber																		
Injector																		
TPM/Radiabeam Crosses																		
300 MeV																		
HE Dump Vac. window									5/3									
Alignment														Monday				
General cave cleanup																		
Controls																		
Vacuum PLC														Test Wed.				
LCW RAW PLC														RTD Issues				
General controls																		
Instrumentation																		
107 & 115 Crosses																		
Install Radiabeam actuators and Optics																		
Toroids																		
BPM's																		
MPS																		
Cryo																		
Kinney Pump rebuild					P.O.						5/18							
ODH Analysis							Approved											
ORC to cooldown									ORC									
Return cave to ODH1/Supervised Access																		
Run Cryoplant/Commission new booster											5/16							
Cooldown CC1, CC2 & CM2															2K			
Safety/ES&H																		
Install Gates																		
Shield blocks in Cryo hatch																		
Misc. items (fence, 3rd layer, grout)																		
Interlocks/gates																		
Shielding Assesment										SARP Review/approval by SRSO								
ORC to commission 300 MeV												update/review SAD, ASE			DOE app. of SAD, ASE, ARR			
ORC to commission gun															Need shielding assesment approved			
ORC to commission injector (50 MeV)															Need shielding assesment approved			
Operation/Commissioning																		
Gun laser into cave																		
Gun electrons																		
RF Station Checkout													Test RF Stations					
CC1/CC2									LCW & Power outages					Warm RF	Warm RF	Cold RF		
CM2									LCW & Power outages					Warm RF	Warm RF	Cold RF		
Injector (50 MeV)																50 MeV?		
Integrated Sys. Checkout (all systems)														debugging,	ckout, etc.			
300 MeV beam																	6/27	

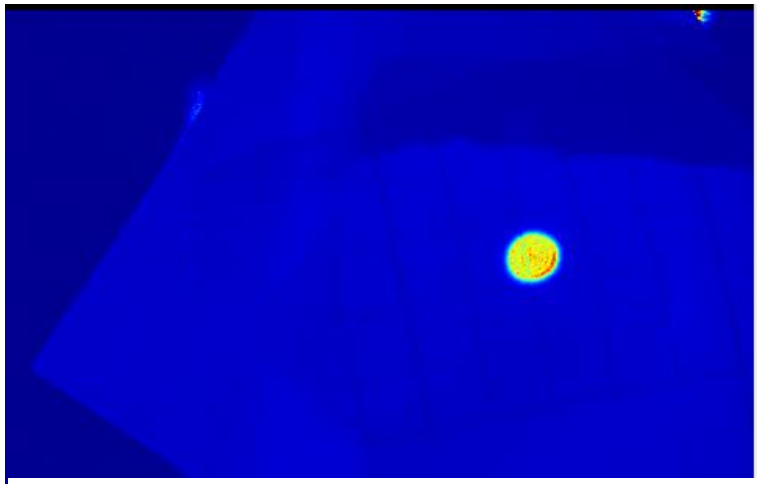
Fermilab

FAST Laser Status

- IR Amplifiers have been realigned for improved nominal running and for testing of the inverse Compton scattering experiment
- Frequency-doubling crystals (IR → UV) have been realigned for a better beam profile
- New transport laser shutter is controlled by the MPS
- Interlock test for laser in cave is complete. UV laser to cave expected in the next few days.



Raw UV spot after conversion



Masked UV spot after 15 meter simulated transfer line. Spot size is about 5mm in diameter

Fermilab

Study Plans for FAST in 2017

- 55MeV Beam phase space tomography experiments
- Flat beam transform ~ Talk by Alex Halavanau 10:00-10:15AM
- Emittance investigation and optimization for both 55Mev and 300MeV beam ~ Talk by Philippe Piot 10:50:11:10AM
- Z-slicer and THz generation. (This will also use Flat beam)
- Investigations of Wakefields effect in SCRF Cavities, Collaboration with LANL, NIU ~ Talk by Bruce Carlsten 10:30-10:50AM
- 300Mev Synchrotron light imaging and spectral analysis